UC San Diego

Local Impact, National Influence, Global Reach

CLIMATE SOLUTIONS for UNIVERSITIES AND LOCAL COMMUNITIES

Overview Presented to
Lawrence Berkeley Lab

August 14, 2008

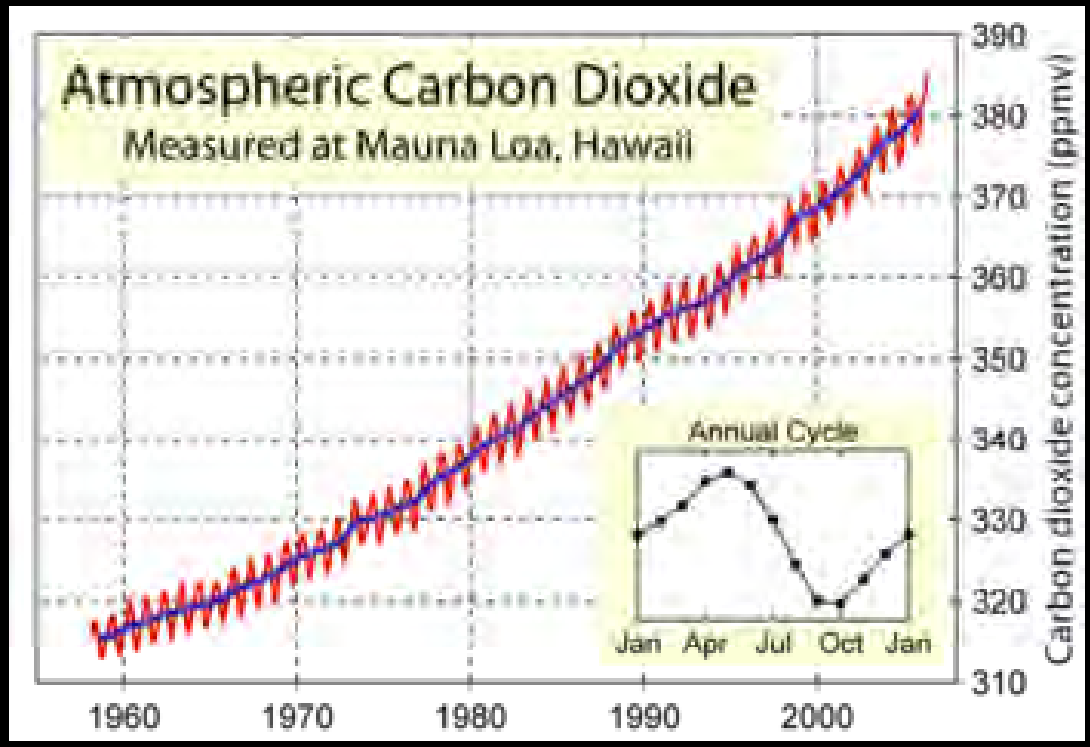
UC San Diego

A Leader in Climate Solutions

UC San Diego and its Scripps Institution of Oceanography has long been internationally recognized for pioneering research in global climate change.

We feel it is imperative to have commensurate leadership in the sustainability of UC San Diego's operations.

As a living laboratory for climate solutions, UC San Diego will be an early adopter for real-world tools and leading-edge technologies for California and global marketplace.



UC San Diego

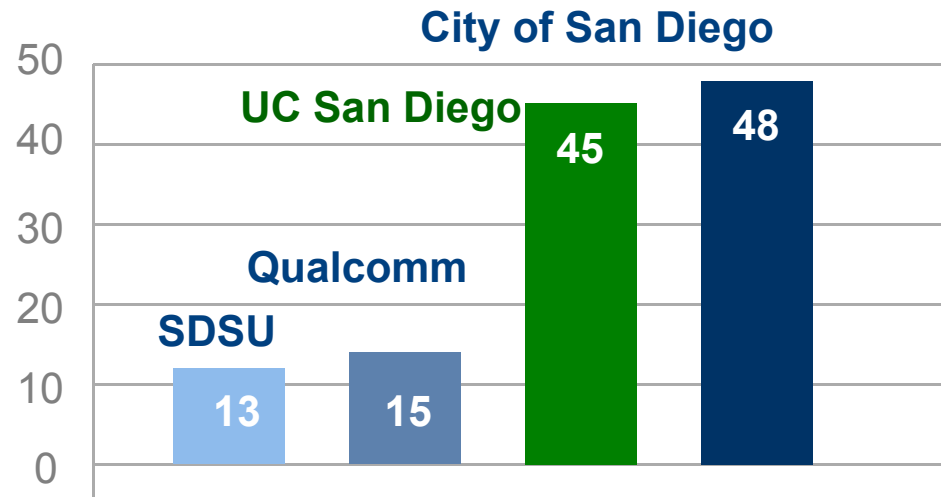
Campus Quick Facts

With a daily population of over 45,000, UC San Diego is the size and complexity of a small city.

As a research and medical institution, we have a higher consumption of energy than comparable communities.

Electricity

Peak demands (MW)



UC San Diego

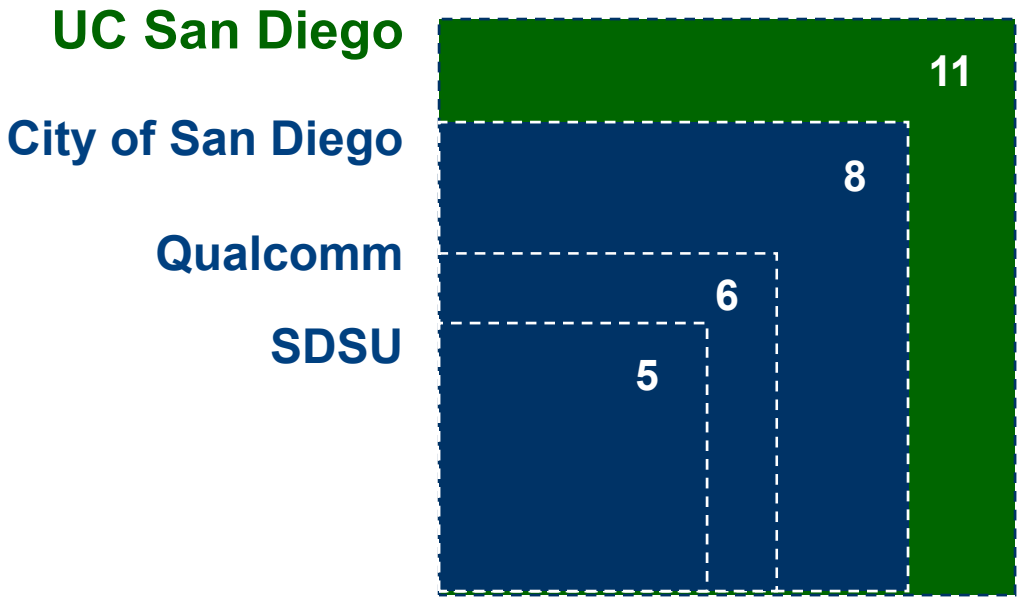
Campus Quick Facts

11 million sq. ft . of facility space, if we were a landlord, we would be one of the largest in San Diego

Included in the daily population of 45,000, we have over 8,000 student residents living on campus

Square Feet of Facility Space

(in millions)



UC San Diego

Campus Quick Facts

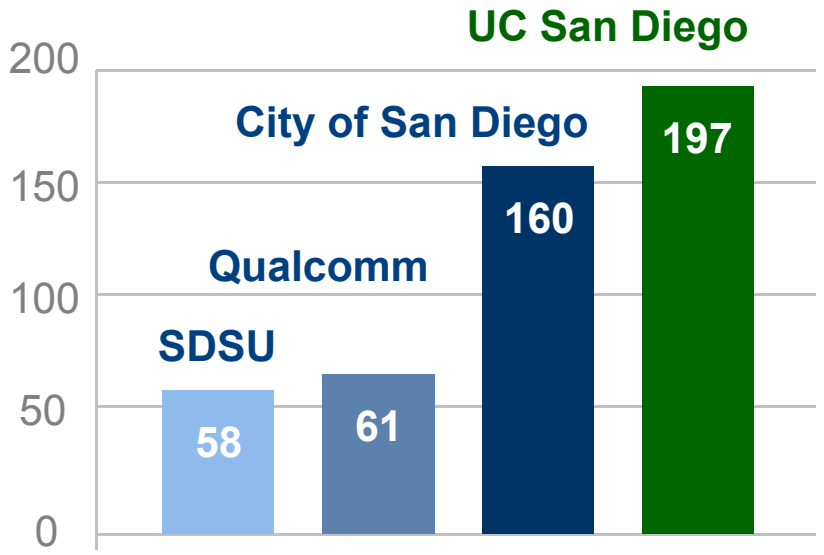
UC San Diego produces 197,000 tons of carbon dioxide each year

UC San Diego is a charter member of, and first university in the California Climate Action Registry

….and one of 7 university members of the Chicago Climate Exchange

Carbon Footprint

metric tons/yr CO2 *(in thousands)*



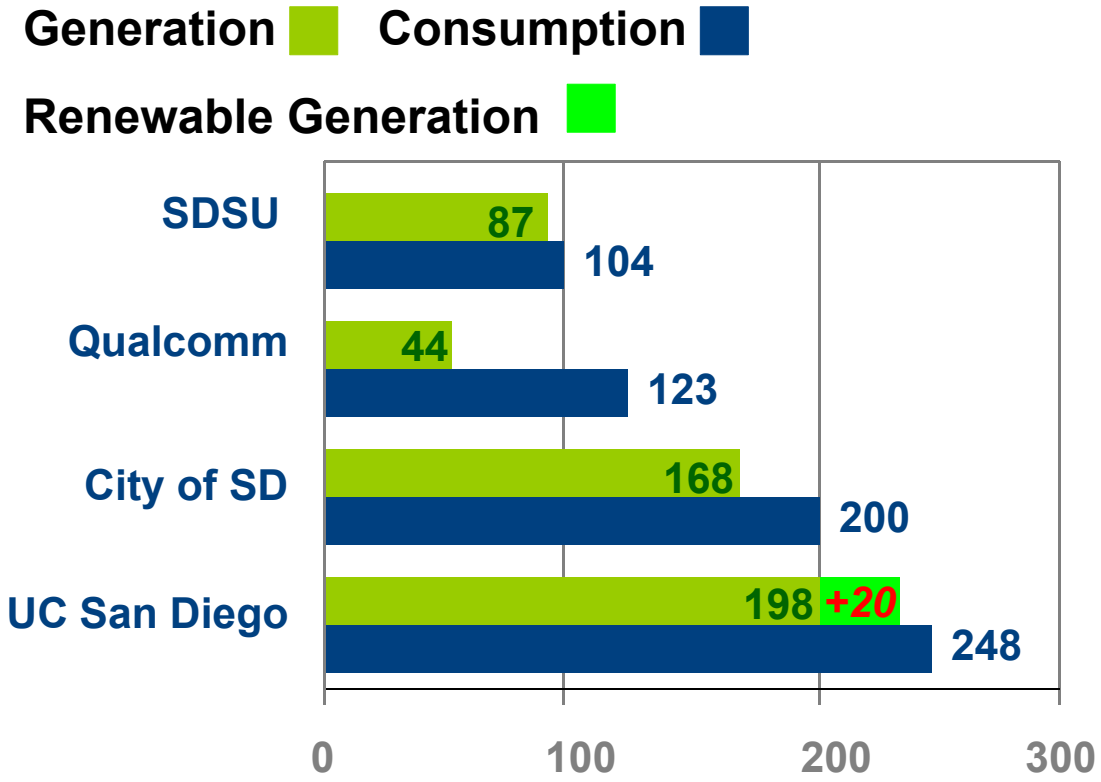
UC San Diego

Campus Quick Facts

We **self-generate 80%** of our electricity demand using efficient, natural gas fueled cogeneration.

Even though UC San Diego generates the majority of its own electricity, we remain one of the top 5 customers of SDG&E

ENERGY (GWhr) PER YEAR



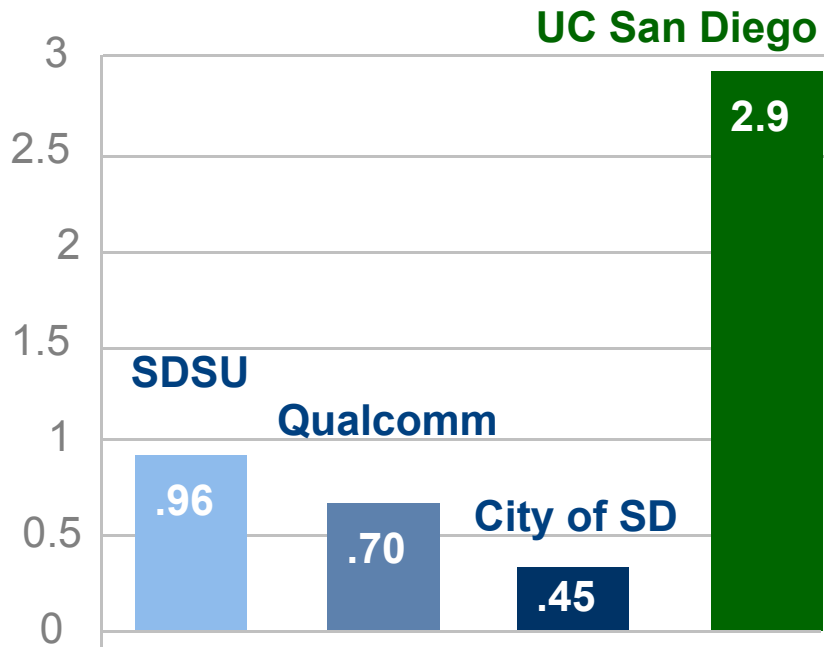
UC San Diego

Campus Quick Facts

UC San Diego uses natural gas to fuel its power plant.

In order to reduce our dependence on natural gas, we are in the process of securing diverse sources of renewable energy

Annual Natural Gas Consumption (Million MMBtu)



UC San Diego

E1

Facility Operations

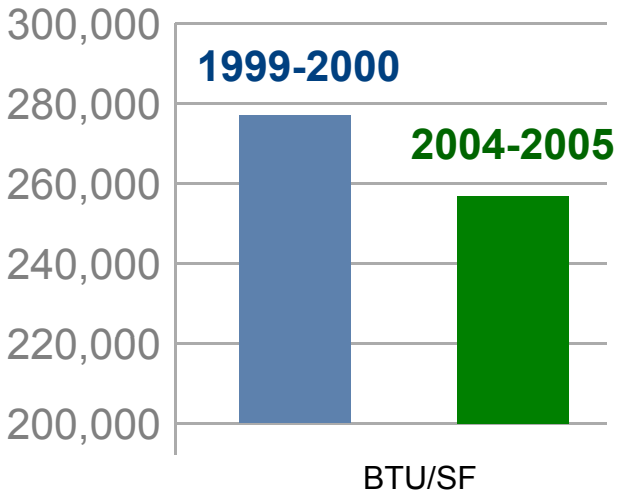
Continue to be a Leader in Resource Conservation and Energy Efficiency

Completed $60M in energy retrofits reducing energy use by 20% or 50M kWh/yr, saving UCSD $12M annually.

Award winning program:

- 6 Best Practice Awards
- 3 Excellence in Energy Efficiency Awards
- 2 Energy Education & Leadership Awards

Even with increased energy intensive activities and growth, facility retrofits have decreased energy consumption per sq. ft.



UC San Diego

E1

Facility Operations: Demand Response

Continue to be a Leader in Resource Conservation and Energy Efficiency

Capacity Bidding Program:

- Contracted with Enernoc
- Day-Of Program

Central Plant Activity:

- Shut down electric chilling
- Increase generation if available

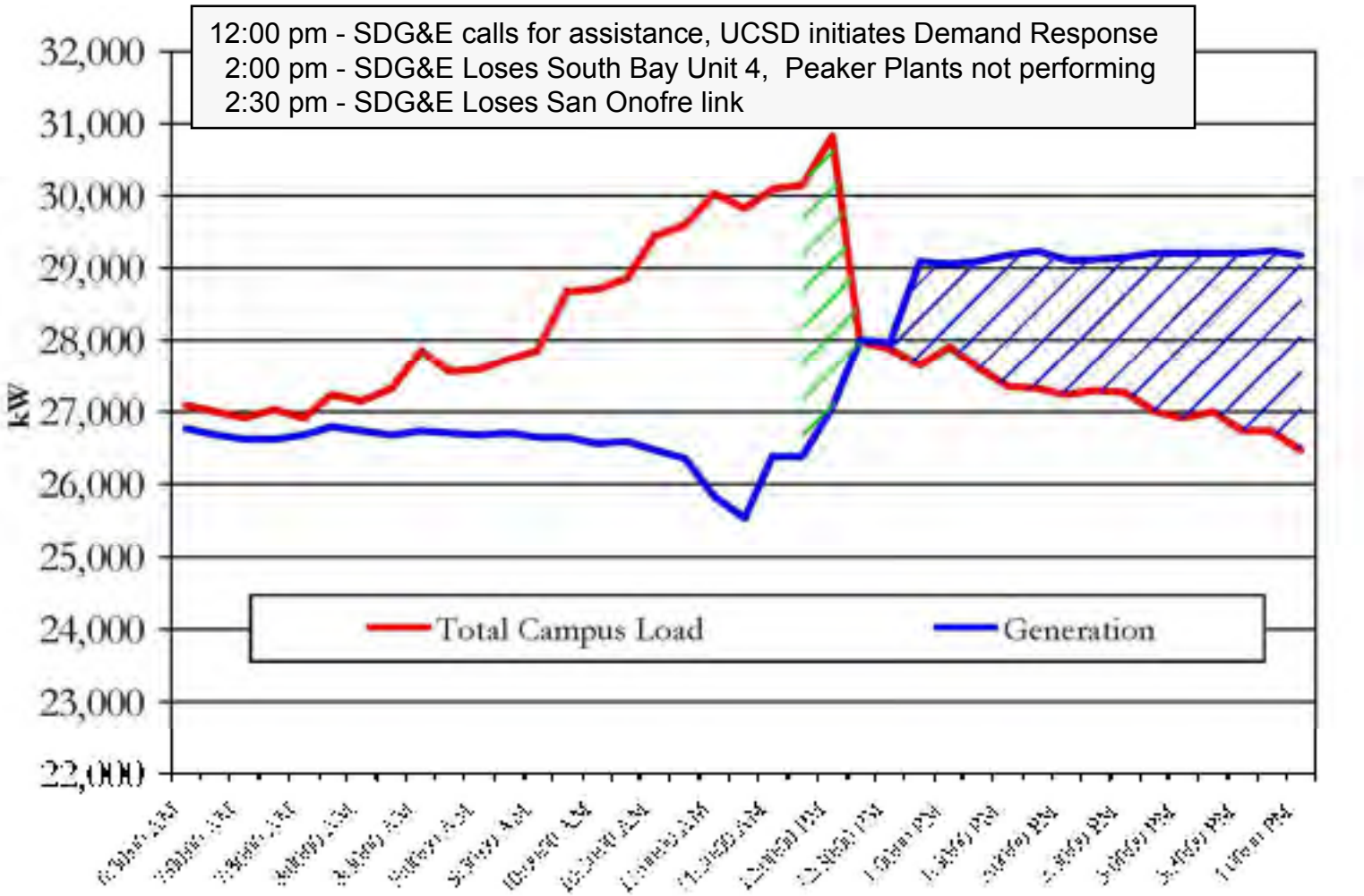
- **Capacity Bidding Program**
- **First University Member of Green Grid Collaborative**
- **Immediate shutdowns and setbacks**
  - 40% Reduction
  - Wild Fire Response

UC San Diego

E1

Facility Operations: Firestorm Response

UCSD Switches from Net *Importer* to Net *Exporter* Within Minutes



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E3

Building Design

At a *Minimum*, Design all Future Campus Buildings to LEED Silver or Gold Standards

Leadership in Energy & Environmental Design (LEED) is the nationally recognized green building rating system

UCSD will exceed UC LEED by achieving a Silver-equivalent rating on all new buildings.

All UCSD design and project managers have received LEED training.

Due to higher capital cost of meeting these standards, the campus will look for donor support to augment building budgets.

UC San Diego

E1

Heterogeneous PQRS Microgrid for Hi Tech

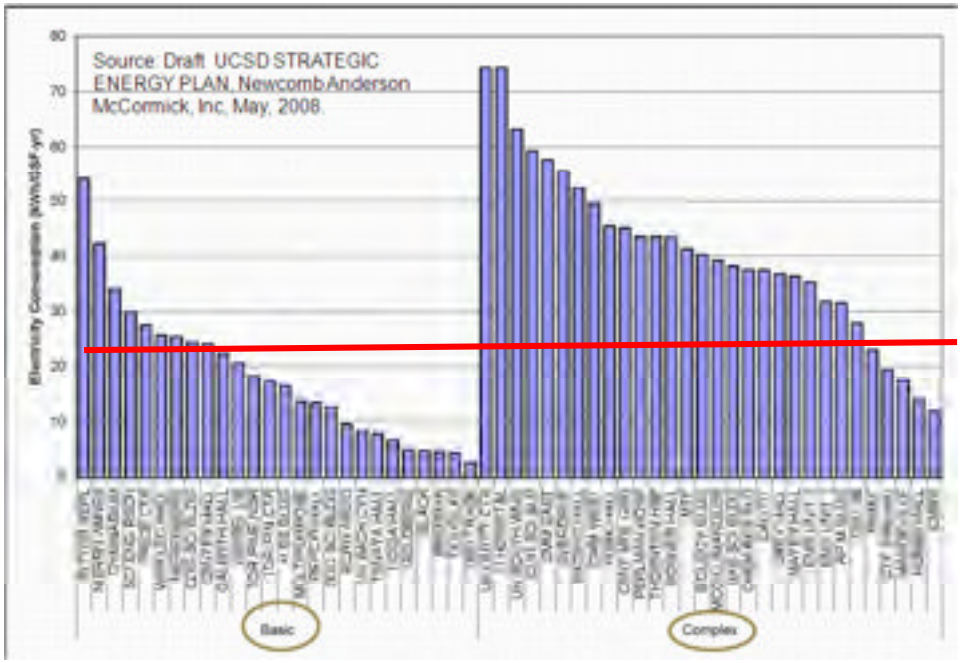
Continue to be a Leader in the Digital Age with Microgrids

secure, disperse, sustainable, dispatchable, energy generation resources that

- reduce costs,
- improve efficiency
- elevate reliability
- minimize emissions,
- customize power quality
- curtail and reschedule loads
- control power down to the appliance level

Benefit the main grid by

- reducing T&D congestion,
- avoiding new generation
- providing voltage support and emergency demand response



- **Exceptionally high energy density (kWh/ft^2/yr) with exceptionally high Power Quality, Reliability and Security required**

UC San Diego

E4

Implementing Efficient Infrastructure

Create a State-of-the-Art Energy Infrastructure

2009

Expand cogeneration capacity by 50% (15 MW) will yield $2.4M annually in savings and reduce emissions.

$2M state grant will continue energy efficiency retrofits with a goal of 1 million sq ft of facilities by 2010

2008

Deployment of green cyber-infrastructure will consolidate computer servers in energy-efficient mobile facilities.

SDSC
SAN DIEGO SUPERCOMPUTER CENTER

UCSD is increasing computing capacity and efficiency with server consolidation and maximum use of "Super Computing" capability

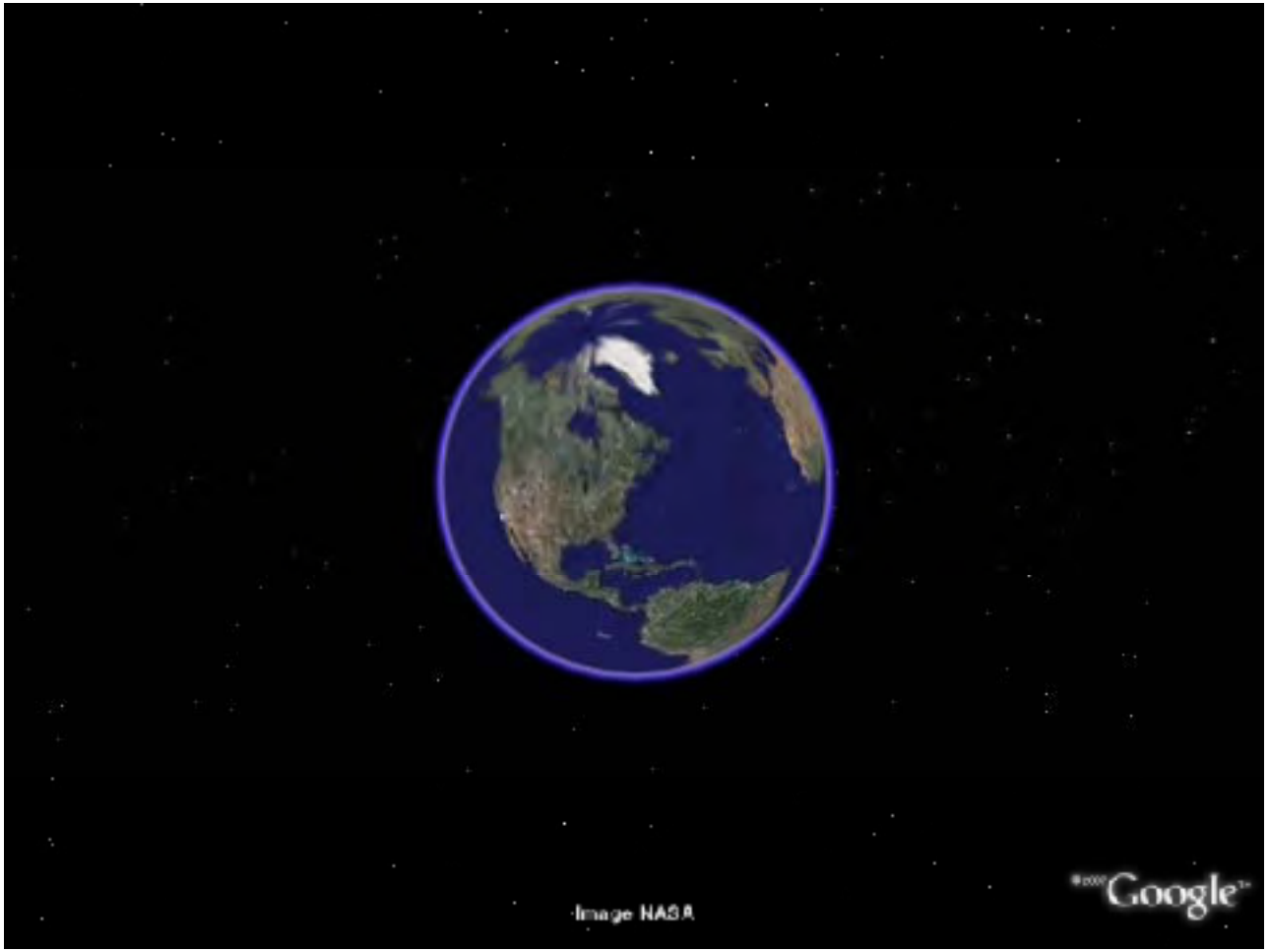
Computing Capacity = High-Tech growth

UC San Diego

Renewable Solar Energy

Become the Leading University Site in the World for Photovoltaic Energy (PV)

1 MW of 16% efficient PV projects will be installed by 12/08




DC Power Generated by PV and Fuel Cells Using Renewable Methane Gas
Waste Heat Utilization
Absorption Chiller
&
Bio Algae Co-Production
Flexible H_2 Co-Production
Advance Energy Storage
NaS Battery
100 kW,7.2 hrs / 500 kW, 30s

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Fuel Cell Energy

Become Leading University Site in the World for *Ultra Clean* Fuel Cells

Campus will install 2.4 megawatts of methane powered Fuel Cells by April 2009.

Methane transported to campus provides an economic, renewable energy resource with a net CO2 reduction.

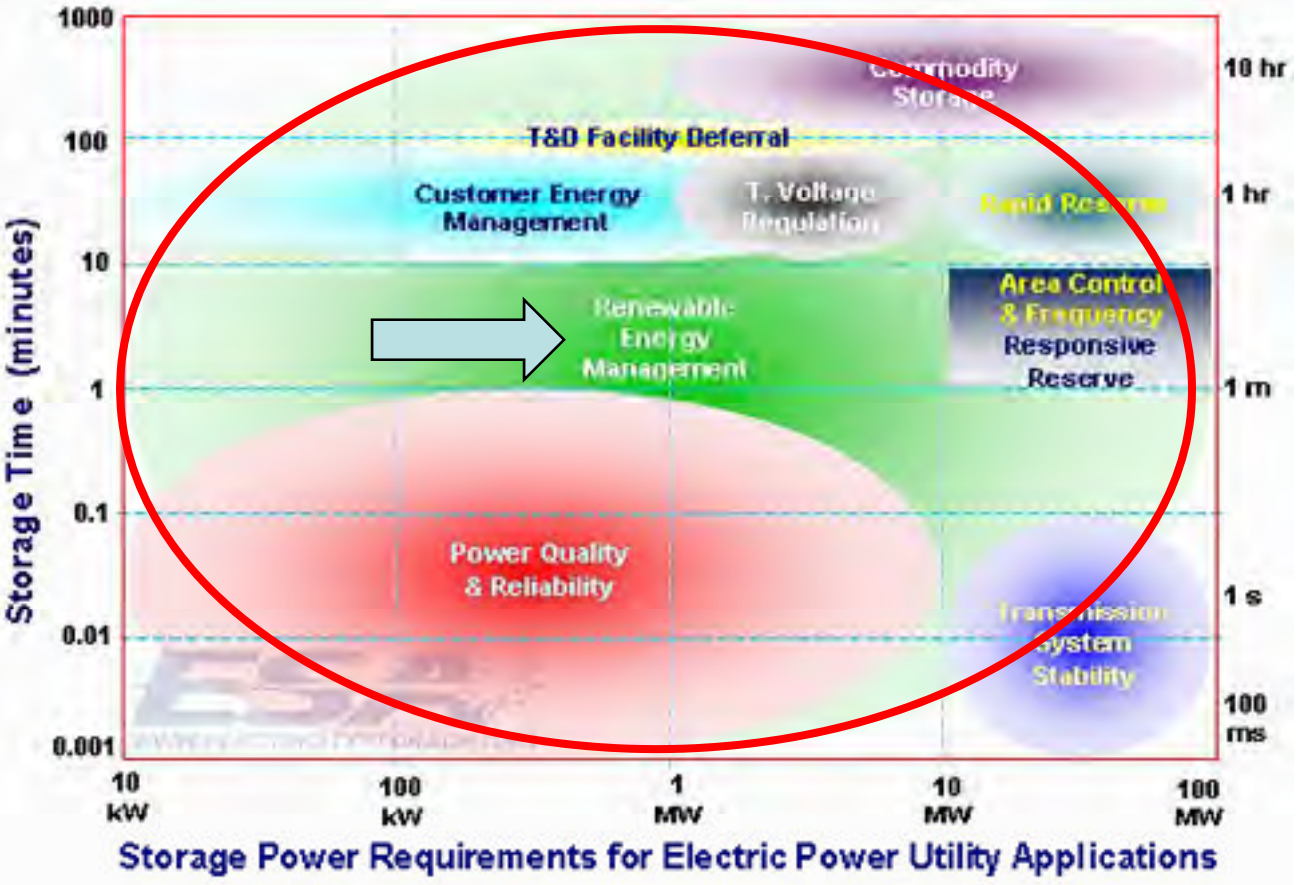
UC San Diego

Advance Energy Storage

CPUC revising SGIP for a buy down incentive of $2000/kW to deploy early commercial energy storage technologies for Permanent Load Shifting

A fully implemented Advance Energy Storage deployment that UCSD will be eligible represents a potential total of $13M

UCSD will cosponsor and host the Montreux Energy Roundtable on Advance Energy Storage, Dec 2-4 08



Data from Sandia Report 2002-1314

Renewable Wind Energy

Become a Pioneer in the Utilization of Off-Peak Surplus Wind Energy

Off-Peak Wind Generation

Throttle Down Power Plant

UC San Diego

Thank You

UC San Diego has a goal of becoming a global model of sustainability for universities and communities alike.